

## Biting Ceratopogonid Midges from the Caroline Islands<sup>1)2)</sup>

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This is the third report on the Micronesian Ceratopogonidae (Heleidae). I have mentioned twelve species in the first report (1940) and seventeen species in the second report (1940). In the present paper I intend to supplement my previous reports with descriptions of other several biting midges collected from the Truk Group of the Caroline Islands by Mr. Keizo Yasumatsu and Mr. Seiichiro Yoshimura under the direction of Professor Dr. Teiso Esaki.

I am most grateful to Professor T. Esaki for the opportunity of examining this interesting collection and I take pleasure in thanking him for this privilege. I am greatly indebted to Professor Dr. Chukichi Harukawa for his cordial encouragement in this study.

The morphological terms used in the present paper mainly are those I have adopted in my recent paper (1937. *Tenthredo*, vol. 1, no. 3) and the abbreviations used in the text are all identical with those in my previous report (1940. *Tenthredo*, vol. 3, no. 1).

### *Forcipomyia ornata* Tokunaga

Tokunaga, 1940. *Tenthredo*, 3:166-167.

*Specimens*.—Females; Olej, Tol Island (Suiyō-tō), Truk Islands; April 3 to 8, 1940.

### *Forcipomyia sauteri* Kieffer

Kieffer, 1912. *Suppl. Ent.*, 1:27-28. Tokunaga, 1940. *Tenthredo*, 4:83-84.

*Female*.—Fore tarsal ratio about 1.4, hind tarsal ratio about 1.13. Vein  $R_{4+5}$  just beyond middle of wing (27:25).

*Specimens*.—Females; Olej, Tol Island (Suiyō-tō), Truk Islands; April 3 to 8, 1940.

### *Forcipomyia fuscimanus* Kieffer

Kieffer, 1921. *Philip. Jour. Sci.*, 18:559. Tokunaga, 1940. *Tenthredo*, 3:82-83.

*Male*.—Relative lengths of distal five antennal segments about 15:40:38:24:32; no terminal stylet. Fore tarsal ratio about 1.1. Wings with  $R_{4+5}$  ending before middle of wing (28:40), relative lengths of second radial cell and its stem vein about 25:40.

*Specimen*.—Male; Olej, Tol Island (Suiyō-tō), Truk Islands; April 3 to 8, 1940.

This specimen is slightly different from the Formosan specimens in the above-mentioned values of the measurement.

1) Contributions from the Entomological Laboratory, Kyoto Imperial University, No. 112.  
2) Results of Professor T. Esaki's Micronesia Expeditions 1936-1940, No. 54

*Atrichopogon (Kempia) arciforceps* sp. nov.

*Male*.—Body about 1.4 mm long. Head dark brown. Antennae (fig. 1) very dark brown; plumose hairs reduced being fanned only on basal four segments from third to sixth segment; segments from third to fifth spherical; those from sixth to ninth discoidal; tenth spherical; eleventh oval; following three segments elongate; terminal stylet present; antennal ratio about 1.21; relative lengths of distal eight segments as follows: 7:7:7:9:11:26:28:40. Thorax dark brown, shining, with setae dark; scutum with a pair of rather broad yellowish stripes along foveae; scutellum yellowish brown. Fore leg pale brown and other legs brown; relative lengths of segments of fore leg about 20:19:10.5:3.5:3:2.3:3.5 and those of hind leg 24:21:10:4:3:2.5:3. Wing (fig. 2) with macrotrichia only on distal area of cells  $R_5$  and  $M_1$ ; venation: relative lengths of two radial veins about 30:80, those of first and second radial cells about 25:55,  $fMCu$  before tip of first radial cell. Halteres white. Abdominal tergites and sternites brown, complete; pleural membranes brown. Hypopygium as in figure 3.

*Locality*.—Sabote—Epin, Pata Island (Mokuyō-tō), Truk Islands.

*Type specimen*.—Female; April 9, 1940.

This species is related to *A. pilosipennis* Tokunaga; the allied species, however, differs from the present species in the following points:

*Atrichopogon (Kempia)* sp. inc. no. 2

*Female*.—Body length about 1.5 mm. Thorax black; scutum shining, setigerous, with paler stripes along foveae as in *A. insularis* Kieffer. Wings with macrotrichia very sparsely spread on distal half, cell  $M_4$  without macrotrichia; relative lengths of two radial cells about 25:80, those of  $R_1$  and  $R_{4+5}$  about 6:18. Halteres white. Abdominal tergites black. Legs and abdomen brown but their distal segments all broken off.

*Specimen*.—Female; Olej, Tol Island (Suiyō-tō), Truk Islands; April 3 to 8, 1940.

*Dasyhelea insularis* Tokunaga

Tokunaga, 1940. Philip. Jour. Sci., 71:214 and 1940. Tenthredo, 3:172.

*Female*.—Body about 1 mm long, almost entirely brown. Antennal intermediate flagellar segments all short and oval; relative lengths of distal eight segments about 11:11:11:12:12:12:12:19. Thoracic notum shining and dark brown, with humeral angles pale brown. Wings with macrotrichia spread as in *D. fumala* Tokunaga; venation:  $R_{4+5}$  ending just at middle of wing, second radial cell subrectangular and longer than its stem vein (27:23),  $fMCu$  under tip of  $R_{4+5}$ . Halteres white. Abdominal tergites dark brown, posterior sternites complete but anterior sternites represented by paired patches; tergal paired punctures absent.

*Male*.—Body about 1.2 mm long, similar in color to female. Antennal ratio about 0.9; relative lengths of distal seven segments about 12:12:12:23:31:30:22. Relative lengths of segments of hind leg about 17:18:10:4.5:4:2.5:2.5. Wing with stigmal area brown, stem vein of radial cell very long, about twice as long as

radial cell (30:16),  $fMCu$  beyond level of tip of  $R_{4+5}$ , its arms very short. Hypopygium similar to that of *D. peliliouensis* Tokunaga.

*Specimens*.—Females and males; Sabote—Epin, Pata Island (Mokuyō-tō), Truk Islands; April 9, 1940.

*Dasyhelea subscutellata* Tokunaga

Tokunaga, 1940. Tenthredo, 3:175-176.

*Male*.—Body about 1.2 mm long. Head and thorax dark brown. Antenna brown, without terminal stylet; antennal ratio about 0.76; relative lengths of distal six segments about 11:11:21:22:18:22. Scutum shining, with humeral angles pale brown. Legs brown; relative lengths of segments of hind leg about 18:18:10:4:3.8:2.5:2.5. Wings with macrotrichia sparsely spread over surface, bare lines along veins broad, stigmal area pale brown,  $R_{4+5}$  ending before middle of wing (21:23)  $fMCu$  under tip of  $R_{4+5}$ . Abdominal tergites brown; hypopygium (fig. 4) with styles narrowed on distal half.

*Specimens*.—Males; Olej, Tol Island (Suiyō-tō), Truk Islands; April 3 to 8, 1940.

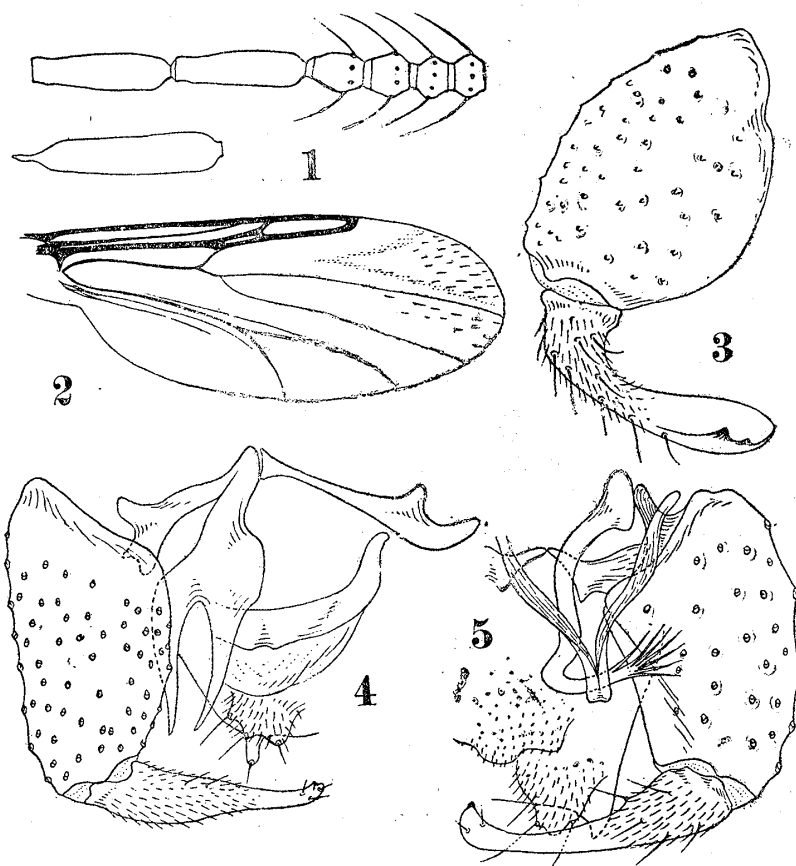


Fig. 1. *Atrichopogon (Kempia) arciforceps*; male antenna. Fig. 2. *Atrichopogon (Kempia) arciforceps*; male wing. Fig. 3. *Atrichopogon (Kempia) arciforceps*; male hypopygium. Fig. 4. *Dasyhelea subscutellata*; male hypopygium. Fig. 5. *Culicoides esakii*; male hypopygium.

*Dasyhelea carolinensis* sp. nov.

*Male*.—Body about 2.2 mm long, entirely dark brown. Antenna with terminal stylet very sharp; antennal ratio about 1.04; relative lengths of distal segments about 16:16:43:34:30:59. Thorax shining. Legs brown, with knee-joints dark brown, tarsi paler, pre-apical rings of all femora obscure and yellowish; proportional lengths of segments of legs about 27:25:17:6.5:4.5:3.5:4 in fore and 29:28:22:9:6:4:4.5 in hind leg. Wing with stigmal area pale brown, macrotrichia spread all over surface, bare lines along veins very distinct; venation:  $R_{4+5}$  ending beyond middle of wing (37:35),  $fMCu$  under base of second radial cell, stem of radial cell about twice as long as second cell (60:32). Halteres brown. Abdominal tergites and sternites dark brown; hypopygium very closely similar to that of *D. maritima* Tokunaga, but anal points more slender and median lobe of parameres broader, differing from the allied species.

*Locality*.—Olej, Tol Island (Suiyō-tō), Truk Islands.

*Type specimens*.—Males, April 3 to 8, 1940.

This species is allied to *D. maritima* Tokunaga, in the allied species, however, the thorax is mat, the antennal ratio is smaller being 0.81, the ultimate two antennal segments are subequal in length and the wing vein  $R_{4+5}$  ends far before middle of the wing, distinctly differing from the new species.

*Dasyhelea peliliouensis* Tokunaga

Tokunaga, 1940. Tenthredo, 3:177.

*Specimens*.—Females; Olej, Tol Island (Suiyō-tō), Truk Islands; April 3 to 8, 1940.

*Culicoides esakii* Tokunaga

Tokunaga, 1940. Philip. Jour. Sci., 71:217-218 and 1940. Tenthredo, 3:178-179.

*Male*.—Body only 1 mm long. Maxillary palpi moniliform; third segment with a sensory pore which consists of short spoon-like sensillae. Antenna without terminal stylet; antennal ratio about 0.73; relative lengths of distal seven segments about 10:10:9:9:25:21:27. Legs brown, with broad paler rings before and beyond knee-joints; hind tibia broadly paler apically; fourth tarsal segments cylindrical. Wing with macrotrichia very sparse, these trichia arranged in a line above distal part of  $M_1$  and on distal margin of cell  $R_5$ , cell  $M_1$  with only three or four trichia along distal margin; third dark costal band broad in cell  $R_5$ , middle dark band of cell  $M_1$  distad that of cell  $R_5$ , second dark costal band covering distal half of first radial cell and basal half of second cell; first radial cell narrow, about half of second cell in length; second radial cell broad, pointed distally,  $fMCu$ ,  $fM_{1+2}$  and  $r-m$  found on same level. Hypopygium (fig. 5) with paired parameres irregularly curved and subpectinate at tip.

*Specimens*.—Males and females; Sabote—Epin, Pata Island (Mokuyō-tō), Truk Islands; April 5 and 9, 1940.

*Culicoides kusaiensis* Tokunaga

Tokunaga, 1940. Philip. Jour. Sci., 71:215:216 and 1940. Tenthredo, 3:181.

*Male*.—Body length about 1 mm. Antenna without terminal stylet; plumose hairs completely absent; segments from seventh to eleventh incompletely segmented being partially fused with each other; twelfth segment subequal to preceding six segments taken together in length; relative lengths of distal three segments about 36:33:33. Wings (fig. 6) with sparsely setigerous; two radial cells subequal in length. Hypopygium (fig. 7) with styles slender, curved, sharply pointed, anal points blunt, triangular and pubescent, paired parameres massive in some specimens.

*Female*.—Body length 1.3 to 1.5 mm.

*Specimens*.—Males and females; Olej, Tol Island (Suiyō-tō), Truk Islands; April 3 to 8, 1940.

Sometimes the hypopygium of males is provided with massive paired parameres and a tridentate fused paramere, differing from the type specimens.

*Culicoides yasumatsui* sp. nov.

*Male*.—Body length about 1.2 mm. Head and appendages brown; antennal ratio about 0.91; relative lengths of distal seven antennal segments as follows: 10:11:10:12:31:29:35; terminal antennal stylet absent. Maxillary palpus (fig. 8) 5-segmented (5:11:15:9:9), short; third segment with a sensory pore just beyond middle. Thoracic sclerites brown, pleural membranes extensively yellow; scutum with many yellow spots: a small spot on humeral pit, two pairs of elongate spots on median area, two obscure round spots on either lateral side; humeral angles (posterior pronotum) yellow; scutellum yellow but with a median brown spot. Legs brown, but bases of all femora white, with white rings before and beyond knee-joints and on distal end of hind tibia; relative lengths of segments of fore leg as follows: 18:16:9:3.5:2.5:1.5:2.5, those of hind leg 19:19:9:4:2.5:2:2.5. Wing (plate 8, fig. 1) adorned with pale areas; first white costal spot covering *r-m* and basal half of first radial cell, second dark radial clouds covering distal half of first radial cell and entire length of second radial cell, second costal white spot situated just beyond tip of  $R_{4+5}$  and somewhat transverse arising from costa and ending just above  $M_1$ , third dark costal cloud also transverse, broader than second costal white spot and slightly convex towards base of wing; cell  $M_1$  with two white spots: one at base and one along distal margin; cell  $M_2$  extensively white, dark on distal one-third and with a semicircular white spot along margin; cell  $M_4$  also with a large semicircular white spot along margin; anal cell white, with a dark cloud at middle covering *Cu* and a dark cloud covering distal section of  $Cu_1$ ; macrotrichia scanty, restricted to distal quarter of wing, numerous in cell  $R_5$ , but practically none between branches of *fMCu*; venation: costa extending far beyond middle of wing length (66:48), second radial cell as long as first and somewhat elongate-oval, *fMCu* just beyond tip of first radial cell,  $M_{3+4}$  and  $Cu_1$  strongly curved. Halteres white. Abdomen extensively white; tergites pale brown; sternites with paired pale brown patches; pleural side with pale brown clouds; hypopygium (fig. 9) brown, with anal points long, styles slender and strongly curved at tip, paired parameres furcate at tip and each with a tubercle at middle.

*Female*.—Body about 1.7 mm long. Antennal ratio about 1.54; distal eight segments showing following relative lengths: 10:10:10.5:22:23:26:28:36; no terminal stylet. Maxillary palpus 5-segmented (7:15:20:7:10). Relative lengths of segments of legs as follows: 20:19:10:4:2.5:2:2.5 in fore and 23:23:11:4.5:3:2:2.5 in hind leg. Wings adorned with pale areas, arrangement of pale spots, venation and distribution of macrotrichia as shown in figure 2 of plate 8. Spermathecae two, equal, oval, each with a short neck part. Other characters mainly as in male.

*Locality*.—Truk Islands.

*Type specimens*.—Males and females; Sabote—Epin, Pata Island (Mokuyō-tō), April 9 and Toloas-Erin (Natu-sima), April 13, 1940.

This species is somewhat related to *C. morisitai* Tokunaga, but in the allied species, the male antennal ratio is smaller being 0.68, the first white costal spot of the wing is found beyond *r-m*, third white costal spot is semicircular and not transverse, and the branches of *fMCu* are almost straight, differing from the new species.

*Culicoides yoshimurai* sp. nov.

*Female*.—Body about 1.4 mm long. Antennae brown, but short basal segments paler and short-oval; distal five segments cylindrical; no terminal stylet; antennal

ratio about 1.25; relative lengths of distal eight segments as follows: 9:9:9:16:19:18:19:25. Maxillary palpus short, 5-segmented (5:11:15:6:6), third segment with a small sensory pore just beyond middle which bears several short sensillae visible externally. Thorax brown, shining; scutum with a pair of small yellow round spots at humeral pits and a pair of discontinuous yellow stripes along foveae. Legs brown; in fore leg, distal half of coxa, both ends of femur,

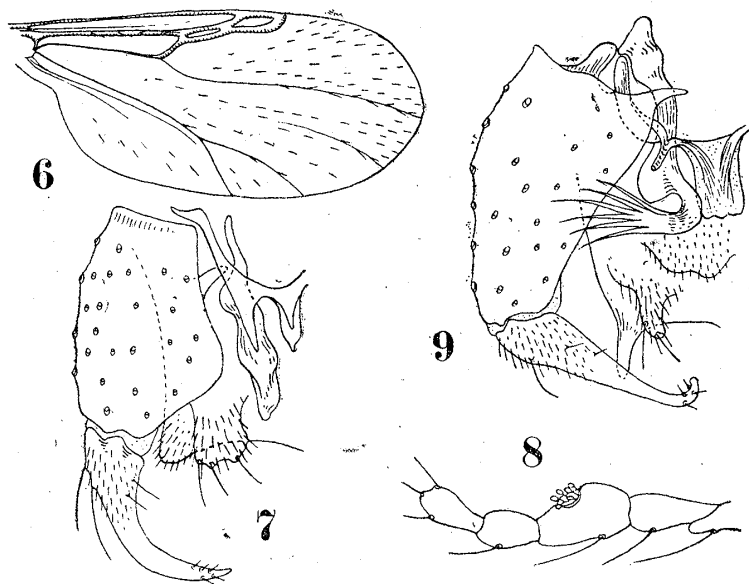


Fig. 6. *Culicoides kusaiensis*; male wing.  
Fig. 7. *Culicoides kusaiensis*; male hypopygium.  
Fig. 8. *Culicoides yasumatsui*; male maxillary palpus.  
Fig. 9. *Culicoides yasumatsui*; male hypopygium.

base of tibia and tarsi all paler; in middle leg, coloration similar to fore leg but coxa entirely brown; in hind leg, bases of femur and tibia and tarsal segments from second to fifth pale brown; relative lengths of segments of fore leg about 14:13:7.5:2.5:1.5:1.2:1.7, those of hind leg 17:16:7:2.5:2:1.5:2; fourth tarsal segments

not cordiform. Wing (Plate 8, fig. 3) short-oval, adorned with white spots; arrangement of clear spots as shown in figure; macrotrichia spread on distal one-fourth, no trichia in cell  $M_4$ ; venation: radial cell and  $R_{4+5}$  entirely dark, first radial cell very narrow, second cell absent  $R_1$  and  $R_{4+5}$  completely fused with each other at this region, stem of  $fMCu$  strongly sinuous,  $fMCu$  before tip of first radial cell. Halteres brown. Abdominal tergites very narrow and brown; sternites without sclerites, pleural sides dark.

*Locality*.—Olej, Tol Island (Suiyō-tō), Truk Islands.

*Type specimens*.—Females; April 6 and 8, 1940.

This species is closely allied to *C. insularis* Macfie which was reported from the Society Islands. In the allied species, however, the antennal ratio is about 1.35, the wings are provided with two radial cells, the stem vein of  $fMCu$  is straight, the first white costal spot is separated from the costal vein and cell  $M_2$  bears no distal white spot differing from the present new Micronesian species.

*Monohelēa insularis* sp. nov.

*Male*.—Body length 1 to 1.5 mm. Head yellowish brown or dark brown, with eyes bare and just contiguous above. Antennae with plumose hairs well developed; antennal ratio 0.86 to 1.21; relative lengths of distal seven segments 10.5:11:11:13.5:31:27.8:28.5; segments cylindrical but last one oval; no terminal stylet. Thorax dark brown, with many setigerous black dots and yellow markings: two discontinuous vittae on scutal median area, two circular spots on humeral pits, three illdefined spots on either lateral side of scutum, scutellum yellow, with four distinct setae; immature specimen with scutum mainly yellow. Legs pale brown or yellowish brown, but distal tips of all femora, tibia and femur of hind leg dark; arrangement of tarsal spurs as follows: in fore leg first segment with three, one at base, one at middle and one at end, second with an apical spur, following two each with two apical spurs; in middle leg, first segment with one at base and two at tip, following three segments each with two at tip; in hind leg, first with one at tip, second with two at tip, other segments without spurs; first segment of hind tarsus sinuate; claws of fore and hind legs equal, each with a slender small basal tooth; those of hind leg very unequal, longer one about five-times as long as other and far longer than fifth tarsal segment (50:34), both without basal tooth; relative lengths of segments of fore leg about 24.5:24:12.5:5.5:3.5:2.5:3 and those of hind leg 33.5:32:11.5:7.5:3.5:4.5:4. Wing (fig. 10) with gray confluent clouds and separated dark clouds; macrotrichia absent; venation: costa slightly produced beyond tip  $R_{4+5}$ , relative lengths of two radial cells about 6.3:14.5, those of  $R_1$  and  $R_{4+5}$  about 8:18,  $fMCu$  just before base of first radial cell,  $M_{3+4}$  ending just before tip of  $R_{4+5}$ . Abdomen yellow; pleural sides dark; hypopygium (fig. 11) brown.

*Locality*.—Olej, Tol Island (Suiyō-tō), Truk Islands.

*Specimens*.—Males; April 6 and 8, 1940.

This species is closely allied to *M. tessellata* Zetterstedt, in which the thoracic notum is brown and the scutum is provided with four pairs of small yellowish spots, the scutellum is brown and with a yellowish median spot and the markings of the wings are distinctly well defined, differing from the present new species.

*Stilobezzia sutisoror* sp. nov.

*Male and female*.—Body length 1.5 to 1.8 mm. Head, thorax, legs and abdomen pale brownish yellow. Eyes separated above. Antennae yellow, but flagellum and plumose hairs of male brownish yellow; antennal ratio about 1.42 in male and 1.57 in female, relative lengths of distal segments about 16:20:55:78:135 in male and 21:25:26:52:52:54:52:84 in female. Thoracic scutum with median area paler being yellowish white, caudoscuteal area of female pale brown; setae of scutum and scutellum dark and arising from basal dark dots. Distal half of fore coxa and all articulations of all leg segments pale brown; fourth tarsal segments cordiform, basal three tarsal segments each with an apical spur, first tarsal segment of male middle leg with an additional sub-basal spur; male claws small and equal, female claws single, very large and with a large basal tooth; relative lengths of segments of legs as follows: in male, 32:32:20:11:3.5:2.5:5 in fore leg and 39:40:21:11:3.5:2.5:5 in hind leg; in female, 31:31:19:9:3:3:6 in fore leg and 39:39:22:10:3:3:6 in hind leg. Wing with macrotrichia spread along distal margins of cells  $R_5$  and  $M_1$  and arranged in a line above distal part of vein  $M_1$ , without color markings; venation: in male,  $R_{4+5}$  ending at distal one-fourth of wing length, second radial cell longer than twice of first (18:7),  $M_{1+2}$  longer than  $r-m$ ,  $fMCu$  under  $r-m$ ,  $M_{3+4}$  ending under tip of  $R_{4+5}$ ,  $Cu_1$  ending under tip of  $R_1$ ; in female,  $R_{4+5}$  extending beyond basal three-

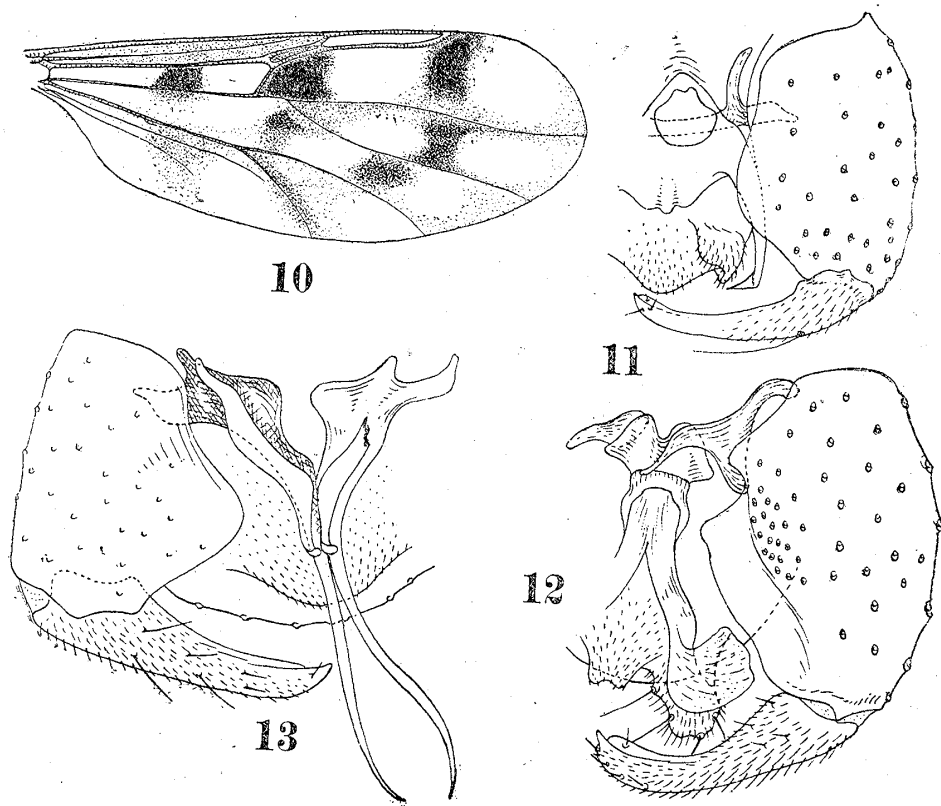


Fig. 10. *Mononelea insularis*; male wing. Fig. 11. *Mononelea insularis*; male hypopygium.  
Fig. 12. *Stilobezzia sutisoror*; male hypopygium. Fig. 13. *Stilobezzia longistyla*; male hypopygium.



fourths of wing length (60:15) and beyond tip of  $M_{3+4}$ , second radial cell about thrice as long as first (21:7). Halteres white. Abdomen yellowish white, but female tergites from first to sixth pale brown, male hypopygium (fig. 12) pale brown, with posterior parameres fused basally, V-shaped and distally expanded into thin plate.

*Locality*.—Truk Islands.

*Type specimens*.—Males and females; Olej, Tol Island (Suiyō-tō), April 3 to 8; Sabote—Epin, Pata Island (Mokuyō-tō). April 9; and Toloas-Erin (Natu-sima) April 13, 1940.

This species is closely allied to *S. soror* Johannsen, in which the male wings are not provided with macrotrichia, the male antennal ratio is about 1.75, the female antennal ratio is 1.2, and the male  $fMCu$  is found under middle of  $M_{1+2}$ , differing from the present species.

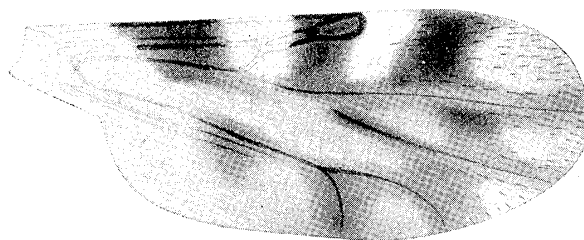
*Stilobezzia longistyla* sp. nov.

*Male*.—Body about 1.5 mm long. Head with eyes just contiguous above. Antenna with scape yellowish brown, plumose hairs and flagellar segments brown, without terminal stylet; antennal ratio about 0.9; relative lengths of distal six segments as follows: 15:15:15:32:56:60. Thorax yellowish brown, with scutum brown. Legs yellowish brown, with fourth tarsal segments cordiform, claws equal simple; tarsal spurs absent; relative lengths of segments of hind leg about 26:26:13:6:2:2.4.5. Wings without macrotrichia and colored markings; venation:  $fMCu$  under base of first radial cell, second radial cell about twice as long as first (13:6), relative lengths of  $R_1$  and  $R_{4+5}$  about 7.5:19. Halteres brown. Abdomen brown, each tergite with a dark band on caudal margin; hypopygium (fig. 13) with styles very strong, posterior parameres very long, slender and filiform.

*Locality*.—Olej, Tol Island (Suiyō-tō), Truk Islands.

*Type specimens*.—Males; April 3 to 8, 1940.

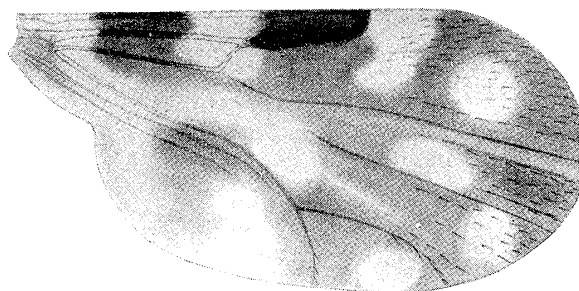
This species is allied to *S. esakii* Tokunaga, but the allied species is darker, the legs being provided with dark markings and the tergites of the abdomen being uniformly dark brown, differing from the present species.



1. *Culicoides yasumatsui* sp. nov. (male)



2. *Culicoides yasumatsui* sp. nov. (female)



3. *Culicoides yoshimurai* sp. nov. (female)

M. Tokunaga: Biting Ceratopogonid Midges from the Caroline Islands